# COASTAL ARCHAEOLOGY IN VICTORIA
# PART 2: ADAPTATION TECHNOLOGY & VOLCANISM

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## INTRODUCTION

In Part 1 of this paper the morphology of coastal archaeological sites in Victoria was described. Much as it is desirable to place coastal sites in a rigorous cultural framework, the present state of knowledge of coastal archaeology in Victoria does not permit this. Instead we can do little more than review some of the more interesting aspects of coastal archaeology. Topical issues that could be discussed are: the relationship through time between resources orientated and generalised economic strategies; the relationship between the level of stone technology, coastal economies and productivity; the importance of fishing in local economies; the relative importance of sandy beach and estuarine habitats and their degree of exposure to ocean swell; changes in coastline and marine habitats induced by fluctuations in sea level; and changes in sea water temperatures and their effect on abundance and variety of marine fauna.

In this paper problems relating to the technology of flint, interpreting various archaeological sites, and man's need to adapt to a changing coastal environment are discussed. Adaptations of particular interest are those arising from natural processes (e.g. rises in sea level and volcanism) or from the actions of man himself (e.g. fire).

## CHANGES IN COASTAL VEGETATION

In evaluating the economic potential of coastal areas at any prehistoric time the resources of the sea and the immediate hinterland must be assessed in concert. Vegetation is a key factor as it largely determines the range of animal and vegetable foods available. Changes in vegetation patterns almost certainly precipitated adaptation. It is likely that coastal vegetation has changed during the past 30 000 years, as sea-level rose and fell. Analyses of pollen from south-eastern South Australia, from Wilsons Promontory and from Lake Keilambete suggest that fluctuations in climate during the past 10 000 years have not been severe enough to modify the main floral associations to any great extent (Dodson 1974a, 1974b, Dodson & Wilson 1975, Hope 1974, Yezdani 1970).

However, in Gippsland, using pollen data that span the last 7000 years Hooley, Southern and Kershaw (1980) demonstrated a dramatic shift from *Casuarina* to *Eucalyptus* woodland about 3000 years before the present (BP) and a further decline in *Casuarina* about 200 BP. Both periods of change are associated with peaks in charcoal debris in soil profiles, which suggests that the changes were fire initiated, and probably by man. The major vegetation change 3000 BP must have affected coastal Aboriginal economy in that area.

Aboriginals periodically set fire to coastal vegetation along other parts of the Victorian coastline during the Late Prehistoric period, but the antiquity of this practice is not known (e.g. Port Phillip—observations by Knopwood (Nicholls 1977: 35, 37, 39)). Thus patterns of coastal vegetation have varied from time to time and resulting changes in Aboriginal economy can be expected in archaeological records.

## COASTLINE CHANGES

Changes in the coastline induced changes in coastal ecology, which in turn affected Aboriginal settlement patterns (Lampert & Hughes 1974), and possibly social and economic patterns, and material culture. During the past 20 000 years the Victorian coastline has receded (Fig. 1) as the sea-level rose after the last glacial period. The coastline stabilised about 6000 BP, which is the oldest dating for most archaeological sites along the present coastline. However, in several coastal areas, Cape Nelson, Cape Woolamai, the southern tip of Wilsons Promontory, Point Hicks and Gabo Island, where the inshore submarine profiles are steep, sites having archaeological records older than 6000 BP may be found. Indeed if the interstadial high of *circa* 35 000 BP reached minus 10 m then these areas may still have the only examples of littoral exploitation dating from those periods.

Port Phillip probably began to fill about 9000 BP and its comparatively flat floor would have precluded extensive occupation anywhere as sea-level rose. Thus most middens around Port Phillip are likely to post-date 6000 BP. Western Port began to fill around 8000 BP when the western margins were inundated. The islands in Western Port would not have been formed until the sea-level was very close to its present height about 6000 BP. Evidence of slightly older littoral exploitation may also be found on the western fringes of the two largest islands in Western Port and on the mainland between Flinders and Hastings. The only other area that may have archaeological littoral sites pre-dating 6000 BP is the coastal strip along the eastern edge of Cape Otway, where the underwater terrain is steeper than in most other coastal areas. Even there the sites are unlikely to be much more than 500-1000 years older than those in other coastal areas in Victoria.

If the sea-level *circa* 6000 BP (see Gill & Hopley 1972, Thom, Hails & Martin 1969, Thom, Hails, Martin & Phipps 1972) was 2-3 m higher than at present, the man-

made littoral deposits in the relatively flat zones of Western Port, Corner Inlet and the Gippsland Lakes would have been inundated and covered by sediments. Aboriginal sites formed then would be further inland than the present shoreline.

As the sea rose to its present level, areas rich in food resources were created (Bowdler 1977: 213). Such areas include Western Port, Port Phillip, Mallacoota Inlet and the Gippsland Lakes. However, it is not clear yet whether the prehistoric inhabitants living in these areas had the required technologies to exploit the resources effectively (Lampert & Hughes 1974).

One of the most important events affecting coastal ecology and therefore human settlement was the inundation of the land bridge joining Tasmania and mainland Australia. Unfortunately the impact of these changes on Aboriginal communities, occupying the Victorian coastline has not yet been documented archaeologically.

Much of the present Victorian coastline is eroding today and there is increasing evidence that many sites less than 500 years old that are or were situated in the vicinity of the foredunes or on low cliff tops, are being eroded away or have disappeared already. Other periods of active erosion may have occurred over the past few thousand years, initiated by minor fluctuations in sea-level. So far there is only one published instance of a changing coastal geomorphology affecting prehistoric human settlement in Victoria (Coutts 1967, Hope & Coutts 1971). On the west coast of Yanakie Isthmus, Wilsons Promontory, there are two dune systems associated with two series of sites 'A' and 'B' (Coutts 1970, 1981). Because 'A' series middens are exposed in the eroded cliffs along the beach they must have once extended further out onto the beach and consequently, when these sites were occupied the coastline must have been further seaward than it is today.

'A' series sites are found on the summits of Pleistocene dunes which run almost at right angles to the present coastline. Peat deposits which outcrop on the beach between these dunes can be linked stratigraphically with soils containing the 'A' series middens. Radiocarbon dating of the latter indicate that they were formed about 3000-6500 years ago and a single date (6010±110 BP) from the peat deposit confirms the stratigraphic relationships (Coutts 1967). The peat contains freshwater gastropods and was probably landlocked at one time, presumably by a foredune further to the west. Results of analyses of the midden materials indicate that nearly all the shellfish in the 'A' series sites were collected from rock platforms; others were from estuaries and sandy beaches. The present coastline fronting the dunes is sandy beach, almost totally devoid of intertidal rock platforms.

Some evidence from the later 'B' series dunes (dating from 3000 BP) suggests that Aboriginal economy may have diversified towards the end of the prehistoric period and that the preferences also changed for the stone materials used. Whilst the change in the methods of collecting shellfish may be seen as an adaptive response to a changing coastal environment, the changes in material culture seem to have been widespread throughout Victoria (Coutts & Witter 1977, Hope & Coutts 1971) and cannot be explained in this way.

## FLINT AND COASTAL RESOURCES USAGE

Large quantities of flint are found in many Victorian coastal archaeological sites. It derives from Gambier limestone (Gill 1957) and has been washed in from offshore, often buoyed by kelp (Fig. 2, Boutakoff 1963, Hossfeld 1966, Mitchell 1949). Gill (1957) suggested that Aboriginals obtained flint from caves, sink holes and re-emerged Pleistocene strand lines along the coast near the South Australian/Victorian border. Although similar flint can be obtained from inland areas of south and north-eastern South Australia (Wright 1971) and from isolated localities in western Victoria (Hossfeld 1966, P. Kenley pers. comm.) it is considered unlikely that the flint nodules found along the Victorian coast came from any of these sources.

The following observations are pertinent to the distribution of flint on the Victorian coast and its use by Aboriginals:

(1) Flint occurs in coastal archaeological sites and on beaches between Wilsons Promontory and the South Australian border, increasing in frequency from east to west.

(2) Flint implements are rarely found in archaeological sites east of Wilsons Promontory.

(3) Flint was used by Victorian Aboriginals at Wilsons Promontory around 5000 BP (Coutts 1970) and at Thunder Point near Warrnambool, around 4300 BP (Coutts 1978). In western Victoria, so called Gambieran implements made from flint have been found in unstratified context (Mitchell 1949). The flint is thought to derive from local outcrops rather than from coastal beaches (Clark 1979). In South Australia none of the implements from Devon Downs or Fromm's Landing (sites less than 5000 years old and little more than 200 km from the coast) were made from flint (Hale & Tindale 1930, Mulvaney 1960, Mulvaney, Lawson & Twidale 1964), but a few fragments of dark blue-grey flint have been excavated at Roonka, a site which dates from about 7000 BP (Pretty 1977). In the central Western District of Victoria, flint has been found in sites which date to less than 3000 BP. No flint artefacts have been found at Keilor, Green Gully or Cloggs Cave (Flood 1974, Mulvaney 1970, Wright 1970), sites which have a much greater antiquity than those mentioned above, and which are no more than 30 km from the present coastline.

However, it should be remembered that 15 000 years ago, the coastline was some hundreds of kilometres further south, and the prospects for collecting flint from beach sources and conveying it to these sites are unknown.

(4) Flint and quartz are the two most common types of stone materials found in recent coastal ar-


Fig. 1 – Approximate shoreline positions in Bass Strait during the post-glacial sea-level rise.

chaeological sites and in general, retouch is rare, there is little deliberate shaping of the flakes, and blade manufacture is minimal (Coutts 1970). At earlier sites a wide variety of implements were made from flint including most types of backed blade, bifacial choppers, and scrapers (Campbell & Noone 1941-43, Mitchell 1949).

(5) Inland, flint artefacts are found at Penola in South Australia; Willaura, Glen Thompson, Murtoa, Condah Swamp, Dooen Swamp, Inverleigh, Lake Bolac and at sites in the Grampians in western Victoria (Campbell & Walsh 1952, Coutts & Lorblanchet 1981, Mitchell 1949).

(6) On the shingle beaches at Port Macdonald in South Australia are large quantities of black rather brittle flint. Grey flints are often the most common components (being used extensively for backed blades) of flint assemblages on the Victorian coastline. Mulvaney (1962), in discussing his basically unretouched flint and bone assemblages from Glen Aire has noted that finely produced stone implements appear to be absent from late Victorian assemblages and he suggests that 'the basic industrial materials of recent Victorian prehistory were of organic origin', as opposed to stone.

Finely produced implements, such as backed blades, were no longer being made in any quantity at the end of the prehistoric period (Coutts 1981). However this does not necessarily mean that Aboriginals at any other time in prehistory were any less dependent on organic materials. As Mulvaney (1962) observed, 'these materials could not be expected to survive for archaeological discovery'; and it is this fact that makes it difficult to argue either way. The presence of certain classes of stone tools in more ancient Victorian sites, suggests that organic materials were being worked with them. There has also been a long tradition of working with bone in Victoria. At least one bone implement similar to those which were made several thousand years later at Glen Aire, has been found at Cloggs Cave in eastern Victoria (Flood 1974). It is not certain that a lack of retouch on tools—such as at Glen Aire—or the absence of finely worked implements, means that there was a reduction in the degree of stone tool use. The crux of the problem is an inability to recognise when a flake (retouched or otherwise) has been used.

No attempt will be made to resolve this dilemma here. However, a working hypothesis is proposed to explain why finely worked tools were abandoned in some parts of Victoria. It is based on premises of increasing population pressure and changing availability of raw materials, in particular, flint. Rising sea-level following the last glaciation, caused erosion of the Tertiary limestone outcrops, now below water, carrying quantities of flint nodules onto the shorelines of south-eastern South Australia and western Victoria where it was collected and used by Aboriginals.

It is not known how long it might take for the flint to find its way onto the beaches of Victoria in sufficient quantities to be regularly exploited. By 14 000 BP (Jennings 1971) the Bassian depression had been inundated, though Tasmania and mainland Australia were still connected by a land bridge through Wilsons Promontory and Flinders Island and the shoreline was within several kilometres of its present position.

Between 14 000 and 6000 BP the coastline stabilised. By at least 5000 BP flint had been washed up onto the beaches of Wilsons Promontory and was used by Aboriginals. If the frequency with which it was used at the Promontory is any indication of its local availability, it was not common 5000 years ago. However, 4000 years later it was a dominant material at coastal archaeological sites. During the late Pleistocene period it might be assumed that population levels in Victoria, as elsewhere in Australia, were increasing (Birdsell 1977) and that tribal and linguistic boundaries were continually adapting to changing environments and in response to changing population pressures. This period might be regarded as one of experimentation when Aboriginals were still discovering suitable outcrops for stone tool manufacture. It appears that they concentrated on exploiting sources of quartz, silcretes and quartzites, and to a much lesser degree, various other types of chert. After the close of the Pleistocene period, the Aboriginal population tended to increase or possibly stabilise, and pressure on stone resources would have increased. Moreover it is likely that the most visible and desirable sources of stone gradually became the property of small groups of Aboriginals.

At the end of the prehistoric period for example (about 1840 in Victoria) seven out of 35 Victorian tribes (Tindale 1974) had control of major 'flint catchment areas' along the coast. Five out of the seven tribes shared the Kulinic group of languages and distribution of flint implements tends to fall within the boundaries of the Dyual sub-group of languages (Fig. 2, Oates & Oates 1970). Trade and exchange networks existed in the central Western District at the end of the prehistoric period and these could have sponsored the trading of flint between coastal and inland areas (Lourandos 1977, McBryde 1977, Mulvaney 1976).

Following Hayden's thesis (1977), there could have been a period of rationalisation as the value of some types of stone material increased. This period peaked after the introduction of a blade technology and the production of finely made implements such as backed blades. Since blade production can be inherently wasteful of materials, economy was achieved by utilising waste products to make utilitarian implements (Watson 1968). In South Australia and south-west Victoria the blade technology was applied to flint which became available about the time of the peak of the period. However sources of chert, jasper and other fine grained materials became less accessible to many Aboriginals and available sources of these materials probably diminished. As a result a much more utilitarian approach to the use of stone was adopted inland, leading to the demise of finely made tools, essentially because their

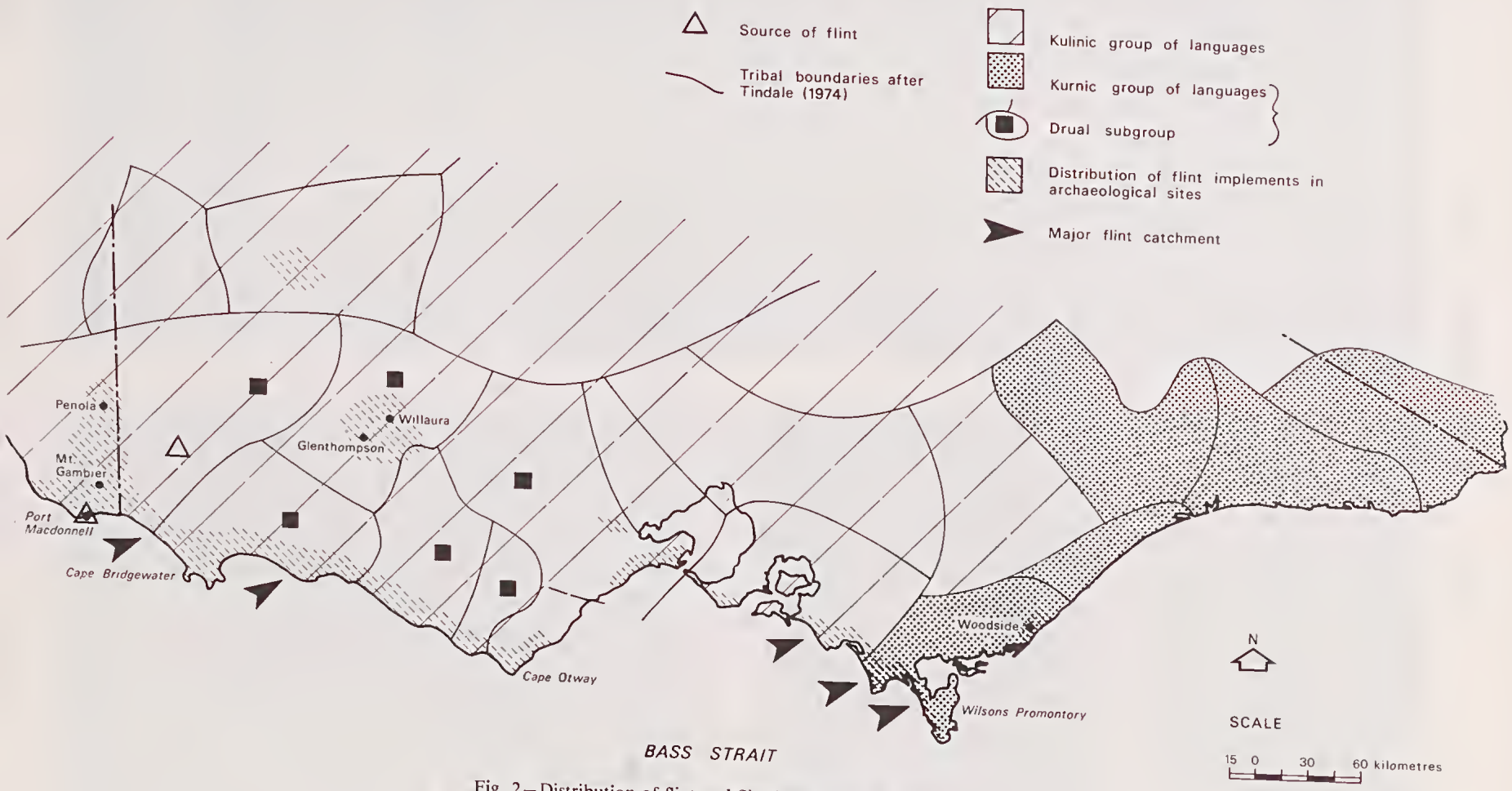


Fig. 2—Distribution of flint and flint implements in Victoria.

manufacture was uneconomic and wasteful of stone resources. This trend spread to the coast where abundant flint materials were available and a 'throw away' technology developed.

These changes would not have happened everywhere simultaneously, but would have depended upon such factors as the availability of raw materials and the strength of local traditions pertaining to the manufacture of stone tools.

To test this theory and its variations more data are required on flint implements from coastal and inland sites, on the sources of flint, and on ways of assessing 'stone economy'.

## VOLCANISM AND COASTAL ADAPTATION

Tower Hill, situated near the coast at Koroit in western Victoria, erupted during the Holocene period and had a pronounced effect on local physiography. The explosive eruption covered the landscape with ash which varied in thickness (Gill 1947, 1967). Moreover, the concommitant intense heat and bushfires would have killed off and burnt back the vegetation in the surrounding areas, and would have had dramatic effects on local wildlife. Consequently the eruption of this volcano probably precipitated a disjunction in social and economic patterns of Aboriginal groups. Ideally a range of archaeological materials need to be located above, below and within the ejectamenta so that cultural adaptations can be monitored.

### Date of the Tower Hill eruption

The Tower Hill eruption and deposition of tuff is presumed to have been a rapid event on the basis of the type of volcanism involved (Gill 1967) and the whole event may have taken place in something less than 50 years. Such a time span is not normally measureable in the archaeological record, though the effects of the eruption are manifested in all subsequent local records in the guise of tuff enriched sediments. If the date of the eruption can be established, the Tower Hill tuffs can be used as a chronological marker for the Warnambool district.

Gill (1953, 1955, 1967, 1972) has several dates from archaeological and geological deposits above, below and within the ejectamenta and the author has several from archaeological deposits above them (Coutts 1981). These dates need to be scrutinised carefully.

The date from Bushfield (Gill 1967), said to come from an archaeological horizon below the tuff (Coutts 1981: Table 7), can be excluded because it was obtained 'from the $CO_2$ fraction, and the provenance of the mineralisation is uncertain' (Gill 1967: 358). However, Gill (1978) considers that the dates of 6500±200 BP (Gill 1967) obtained from marine shells from the Merri canal, and 6570±115 BP (E. D. Gill pers. comm.) and 5850±320 BP (Gill 1967) from marine shells of the Pertobe Coquina, which overlies the tuff, are reliable. A date of 8700 BP (E. D. Gill pers. comm.) has been obtained from a laminated mammillary calcrete at Dennington which is presumed to be the same age as the calcrete underlying the tuff at Thunder and Pickering Points.

Two suites of dates are available for midden deposits which clearly postdate the eruption: one from middens found within soil horizons associated with mobile dune systems at Armstrong Bay and the other from middens overlying the tuffs at Thunder Point.

The earliest $C^{14}$ date for Armstrong Bay is 5680 BP (Campbell 1967) and is similar to Gill's earliest date of 5120 BP (Gill 1967). However our investigations (Coutts 1977, 1978) and those of Campbell (1967) failed to locate tuffs (which outcrop on the beach) underneath the dunes and the middens at the eastern end of Armstrong Bay. Gill (1953, 1955, 1967, 1971) on the other hand has found the tuff under the dunes on the western side of the Bay, near Gormans Lane, but this is well away from where the archaeological work has been conducted. Thus the relationships between the dunes, the middens and the tuff remain unclear in the eastern area, although Gill is certainly correct in concluding that the tuff is older than the dunes. A radiocarbon date from archaeological deposits a little above stratified tuff deposits at Thunder Point is 4130±200 BP (Coutts 1977), and it can safely be assumed that the Tower Hill volcano erupted some time before this.

Some disagreement between Gill and the author persists over the interpretation of a date obtained from shells from Pickering Point. In 1972, Gill claimed to have found shells 'within the Tower Hill tuff which dated to 7300±150 BP' (Gill 1972). The photographic record (Gill 1972), Gill's brief description of the site from which the $C^{14}$ sample was taken, the results of the later textural analysis of the sediments plus archaeological excavations at Pickering Point to determine the stratigraphic context of the archaeological debris, suggest that what was dated were shells from dispersed archaeological debris recemented into tuff rich sediments sometime after the eruption. Hence the significance of the 7300±150 BP date in the context of dating the Tower Hill eruption is unclear.

More recently Mortlock (1977) has attempted to date the Tower Hill ejectamenta directly by thermoluminescence dating; but as this results in the scoria predating the tuff, which is inconsistent with the geological evidence, these dates must be regarded as unreliable.

On evidence available at present, the Tower Hill volcano erupted between about 6600 and 8700 BP.

## EVIDENCE FOR CULTURAL CHANGES

There are no reliable archaeological data from the period before the eruption of Tower Hill (Coutts 1976). For the post-eruption period, there are copious data from surface collections and from excavations at Thunder Point and Armstrong Bay.

Unfortunately stratigraphic and cultural evidence from Armstrong Bay is confused. Investigations by Gill have suggested that there are at least two soil horizons associated with the post-eruption coastal dune system and which are connected with Aboriginal occupation.

Gill (1955) dated occupational debris, which included large numbers of bone points from the latest of the two soils as 1750 ± 20 BP. More recently he reported that the bone industry was associated with the older soil horizon (Gill 1967). In contrast Kenyon (1912) and Mahony (1912) claimed that the bone points at Armstrong Bay came from the surface (confirmed later by Mitchell 1958), and Mahony went so far as to say that no Aboriginal material could be found in the oldest horizons of the deeper blowouts. Campbell (1967) concluded that there has been one period of soil development at Armstrong Bay. However his evidence is confusing because he obtained very different radiocarbon dates, 5680 BP and 1280 BP for two different exposures of this soil.

More recent archaeological work in this area (author), has revealed the presence of one soil horizon at the western end of the beach. A single radiocarbon date of 2450 BP for the upper part of the soil places it in the middle of the present sequence of radiocarbon dates for this area (Coutts 1981: Table 1). At the eastern end of the beach there is evidence for at least two closely spaced soils containing archaeological materials, within the beach face of the leading dune system, and dating from 570 ± 80 BP to 610 ± 110 BP and 2685 ± 110 to 2925 ± 95 BP respectively.

Judged on the dates alone, Aboriginals were exploiting the coastal resources at Armstrong Bay some 2000 years after the eruption. They camped intermittently in the vegetated areas of the dunes for the next 5000 years, and it is probable that throughout the history of the dune system at Armstrong Bay there may have been continuous soil development, punctuated by periods of dune stability and destabilisation during which parts of the vegetated landscape and the archaeological deposits were buried under loose sand.

A 3000 year old midden deposit in the leading edge of the present foredune suggests the coastline at that time was further seaward. Today these middens are approximately 3 m above high water mark and are covered by more than 6 m of sand.

A key feature of the Armstrong Bay site is the variety of faunal remains found in them. Gill (1967) and Campbell (1967) have suggested that the middens in the older soil horizons contain shellfish from both rock platforms and sandy beaches. Archaeological work in this area suggests that for a period of 2500 years shellfish collecting was confined to rock platforms with almost no evidence of exploitation of sandy beach animals. Today, the Armstrong Bay coastline is a sandy beach. Thus, if the ecology of predominant shellfish taxa found in middens reflects the type of coastline in the vicinity, it seems likely that the Armstrong Bay coastline has undergone a number of changes in physiography since the volcano erupted.

The same cannot be said of the middens at Thunder Point, which are on the tail of the volcanic ash shower and in a different physiographic situation. From 4300 BP until 800 BP there is no evidence of any significant shift in shellfish collecting strategies, although there is evidence that the coastline itself in the vicinity of Warrnambool has undergone significant changes over this period. Clearly one or more of the occupation phases at Armstrong Bay was associated with the manufacture of bone points, spatulates etc., (Coutts *et al.* 1976), and from at least 3000 BP Aboriginals utilised coastal flint, making a variety of tools including backed blades. They hunted a wide range of terrestrial animals but evidence of fishing is minimal. At Thunder Point, there is barely any material culture evidence as the site was associated almost exclusively with shellfish gathering.

## CONCLUDING REMARKS

In these two papers discussion has been limited to aspects of coastal archaeology in Victoria. It is apparent that there are many varieties of coastal middens and that their interpretation has and will prove to be difficult. Indeed coastal archaeology in Victoria is still in its infancy. The need for intensive, long term regional and local studies cannot be over-stressed. Some of the most interesting areas will be adjacent to Port Phillip, Western Port, Tower Hill, the Gippsland Lakes, and Mallacoota Inlet.

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